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PATENT COOPERATION TREATY

PCT/JP2003/015415



# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference NE-70124WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/JP2003/015415	International filing date (day/month/year) 02 December 2003 (02.12.2003)	Priority date (day/month/year) 03 December 2002 (03.12.2002)
International Patent Classification (IPC) or national classification and IPC H01L 33/00, H01S 5/343		
Applicant NEC CORPORATION		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 4 sheets, including this cover sheet.  
  
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
 These annexes consist of a total of \_\_\_\_\_ sheets.
- This report contains indications relating to the following items:
  - I ☒ Basis of the report
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand 02 December 2003 (02.12.2003)	Date of completion of this report 06 September 2004 (06.09.2004)
Name and mailing address of the IPEA/JP	Authorized officer
Facsimile No.	Telephone No.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/JP2003/015415

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

☒ the international application as originally filed

☐ the description:

pages \_\_\_\_\_

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the claims:

pages \_\_\_\_\_

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement under Article 19

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the drawings:

pages \_\_\_\_\_

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the sequence listing part of the description:

pages \_\_\_\_\_

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	1-15	YES
	Claims		NO
Inventive step (IS)	Claims	11-15	YES
	Claims	1-10	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims		NO

**2. Citations and explanations**

The following documents are cited in the ISR:

Document 1: GB, 2323210, A (Hewlett-Packard Co.), 16 September, 1998 (16.09.98)

Document 2: JP, 2002-185085, A (Sharp Corp.), 28 June, 2002 (28.06.02)

**Claims 1-10**

Document 1 (particularly, descriptions on page 5, lines 13-26) and document 2 (particularly, descriptions in paragraph 0016) describe that the well layer and the barrier layer of a quantum well structure that constitute a light-emitting layer are doped with O or S as an impurity. Although neither of the above-mentioned documents clearly describes that they are doped almost uniformly, it is considered to be obvious for a person skilled in the art that, in general, when a layer structure is doped with an impurity, the concentrations of the impurity in the layer structure are made uniform.

Referring to some documents, the applicant claims that there exists a common technique whereby a multiple-quantum well structure is not uniformly doped, so it would not be obvious that the concentrations of the impurity in the layer structure are made uniform in documents 1 and 2. However, it is considered perfectly normal that a general description of introducing an impurity in a particular semiconductor device structure (e.g., "a quantum well activating region" in document 1) means that the impurity is introduced uniformly in the semiconductor device structure. In addition, document 2 describes that "either or both of the well layer and the barrier layer...are doped with an impurity...", and it is clear that the description inclusively means doping both the well layer and the barrier layer with an impurity. Accordingly, even if there exists a common technique wherein a multiple-quantum well structure is not uniformly doped, it is not considered that uniform doping with an impurity is excluded from what is meant by the descriptions in cited documents 1 and 2.

Documents 1 and 2 also describe the growth by means of MBE method, etc., which is not described in the specification of the present application, but it is not clear from the descriptions in the said specification that uniform doping is difficult in the growth by means of such methods.

Using a nitride semiconductor substrate as a substrate for growth is described in document 2 (e.g., paragraph 0012), and it is considered to be obvious for a person skilled in the art that it is preferable that the surface dislocation density of a nitride semiconductor substrate as a substrate for growth is low. Furthermore, it is considered that the surface dislocation density values of nitride semiconductor substrates described in claims 3 and 4 could normally be selected. It is also shown in document 2 (for example, the descriptions in paragraphs 0012 and 0013: Supply of  $\text{SiH}_4$ ) that a semiconductor layer containing a 4B group element as impurity is provided between the substrate and a phosphor layer.

In addition, it is shown in document 2 (particularly, the descriptions in paragraph 0014) that the barrier layer of a quantum well structure that constitutes a phosphor layer contains In.

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**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of : V

In addition, the concentration of an impurity and that of a carrier described respectively in claims 8 and 9 are values that a person skilled in the art could have set as required through normal technical activities such as testing measurement.

Claims 11-15

The subject matters of claims 11-15 are neither described in any of the documents cited in the ISR, nor obvious to a person skilled in the art.